

**WHAT IS CLAIMED IS:**

1. A method for determining how much margin there is in a design of an optical span, said method comprising the steps of:

- 5       designing an operable optical span;  
      performing a margin analysis on said operable optical span to determine how much change said operable optical span can tolerate before said operable optical span becomes an inoperable optical span.

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2. The method of Claim 1, further comprising the step of presenting the results of the margin analysis to a user.

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3. The method of Claim 1, wherein said step of designing an operable optical span further includes selecting components that make-up the optical span.

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4. The method of Claim 1, wherein said step of performing a margin analysis on said operable optical span further includes making a continuing series of user-defined changes to the design of said operable optical span and analyzing the changed design after each iteration of a user-defined change to determine when the changed design fails to meet a minimum performance criteria.

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5. The method of Claim 4, wherein said minimum performance criteria is an optical signal noise ratio or a received power value.

6. The method of Claim 1, wherein said step of performing a margin analysis on said operable optical span further includes determining an allowable amount of change  
5 that can be made in a position of an in-line amplifier relative to adjacent in-line amplifiers.

7. The method of Claim 1, wherein said step of performing a margin analysis on said operable optical span  
10 further includes determining an allowable amount of change that can be made to the lengths of all segments of fiber optic cables.

8. The method of Claim 1, wherein said step of  
15 performing a margin analysis on said operable optical span further includes determining an allowable amount of change that can be made in one segment of fiber optic cable when there are no changes made to the remaining segments of fiber optic cables.

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9. The method of Claim 1, wherein said step of performing a margin analysis on said operable optical span further includes determining how many channels can be tolerated by the design of the optical span.

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10. An optical route design system, comprising:

a processor capable of determining whether a design of  
an optical span is an operable optical span and further  
capable of performing a margin analysis on said operable  
5 optical span to determine how much change said operable  
optical span can tolerate before said operable optical span  
becomes an inoperable optical span; and

a display, coupled to said processor, capable of  
presenting the results of the margin analysis to a user.

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11. The optical route design system of Claim 10,  
further comprising a database capable of storing  
information about components that can be selected by the  
user to make-up the optical span.

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12. The optical route design system of Claim 10,  
wherein said processor in performing a margin analysis on  
the operable optical span is capable of making a continuing  
series of user-defined changes to the design of said  
20 operable optical span and analyzing the changed design  
after each iteration of a user-defined change to determine  
when the changed design fails to meet a minimum performance  
criteria.

25 13. The optical route design system of Claim 12,  
wherein said minimum performance criteria is an optical  
signal noise ratio or a received power value.

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14. The optical route design system of Claim 10,  
wherein said processor in performing a margin analysis on  
the operable optical span is capable of determining an  
allowable amount of change that can be made in a position  
5 of an in-line amplifier relative to adjacent in-line  
amplifiers.

15. The optical route design system of Claim 10,  
wherein said processor in performing a margin analysis on  
10 the operable optical span is capable of determining an  
allowable amount of change that can be made to lengths of  
all segments of fiber optic cables.

16. The optical route design system of Claim 10,  
15 wherein said processor in performing a margin analysis on  
the operable optical span is capable of determining an  
allowable amount of change that can be made in one segment  
of fiber optic cable when there are no changes made to the  
remaining segments of fiber optic cables.

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17. The optical route design system of Claim 10,  
wherein said processor in performing a margin analysis on  
the operable optical span is capable of determining how  
many channels can be tolerated by the design of the optical  
25 span.

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18. A method for analyzing the performance of a design of an optical span, said method comprising the steps of:

selecting components that make-up the optical span;  
5 optimizing the optical span to make an operable optical span;

performing a margin analysis on said operable optical span to determine how much change said operable optical span can tolerate before said operable optical span becomes  
10 an inoperable optical span; and

presenting the results of the margin analysis to a user.

19. The method of Claim 18, wherein said step of  
15 optimizing the optical span to make an operable optical span further includes the steps of:

analyzing the design of the optical span;

determining whether the design of the optical span is an operable optical span; and

20 if not, analyzing a received signal spectrum and adjusting a transmitted signal spectrum to improve the characteristics of the received signal spectrum, wherein the received signal spectrum is continually analyzed and the transmitted signal spectrum is continually adjusted  
25 until there is an operable optical span.

20. The method of Claim 18, wherein said step of performing a margin analysis on said operable optical span further includes the steps of:

receiving at least one parameter identifying  
5 incremental changes that are to be made to said operable optical span;

incorporating an incremental change into at least one component of said operable optical span in accordance with a case type;

10 analyzing the changed optical span;

determining whether the changed optical span is an operable optical span;

if yes, incorporating the next incremental change into the at least one component of said optical span in accordance with the case type and repeating  
15 the analyzing step and the determining step until the changed optical span is no longer an operable optical span;

if not, identifying the previous incremental change as a margin limit for the at least one component in accordance with the case type; and  
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determining whether all of the components of the optical span and all of the case types have been analyzed;

if not, incorporating an incremental change  
25 into the next at least one component of said operable optical span in accordance with the case type and repeating the analyzing step and the two determining steps until all of the components of the optical span and all of the case types have been analyzed;

if yes, organizing the results of the margin  
limits.

21. The method of Claim 20, wherein the case type is  
5 a sensitivity case during which there is determined an  
allowable amount of change in a position of an in-line  
amplifier relative to adjacent in-line amplifiers.

22. The method of Claim 20, wherein the case type is  
10 a simultaneous case during which there is determined an  
allowable amount of change that can be made to the lengths  
of all segments of fiber optic cables.

23. The method of Claim 20, wherein the case type is  
15 an independent case during which there is determined an  
allowable amount of change that can be made in one segment  
of fiber optic cable when there are no changes made to the  
remaining segments of fiber optic cables.

20 24. The method of Claim 20, wherein the case type is  
a channel case during which there is determined how many  
channels can be tolerated by the design of the optical  
span.

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